PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 3267-01-WO	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/US2005/007544	International filing date *(day/month/year)* 08.03.2005	Priority date *(day/month/year)* 10.03.2004
International Patent Classification (IPC) or national classification and IPC INV. C08F8/32 C08F255/10 C08F8/46 C08F210/12 C10M149/02		
Applicant THE LUBRIZOL CORPORATION et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in celectronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26.01.2006	07.04.2006
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Hollender, C Telephone No. +49 89 2399-8165

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2005/007544

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

   Description, Pages

   1-24 as originally filed

   Claims, Numbers

   1-21 filed with telefax on 26.01.2006

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-21
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-21
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents cited in the International Search Report (ISR):

D1: WO-A-01/98387 (cited in the application)
D2: EP-A-0396297
D3: US-A-6107257 (cited in the application)
D4: US-A-4904401

1. D1 (cf. the passages cited in the ISR) is regarded as being the closest prior art to the subject-matter of amended independent claims 1 and 18.
The subject-matter of amended claims 1 and 18 differs mainly from the disclosure made in D1 in that the aromatic amine (b) has to be selected from a group consisting of eleven specific aromatic amines which were originally specified in dependent claim 7 as filed.
In D2 and D3 (cf. the respective passages cited in the ISR), one of the specific aromatic amines (i.e., 4-aminodiphenylamine) is explicitly disclosed and used in the Examples, but the specific isobutylene-diene copolymer (a) which is required in claims 1 and 18 of the present application has not been reacted therein with said specific aromatic amine.
There is, inter alia, no mention of the specific aromatic amines of amended claims 1 and 18 in D4 (see the passages cited in the ISR).
Hence, the subject-matter of the independent claims 1 and 18 is novel over D1 to D4 (Article 33(2) PCT).

2. The problem to be solved by the present invention may be regarded (cf. page 1, paragraph [0002] and page 2, paragraph [0006]) as the provision of a low cost dispersant viscosity modifier having improved performance in engine tests, providing a good viscosity index and good soot dispersion (i.e. less than 12 mm^2/sec viscosity increase at a soot loading of 6%) and toleration properties, particularly in diesel engine, and especially in heavy duty diesel engines employing exhaust gas recirculation.

The solution to this problem (only exemplified in the Examples of the present application for one of the eleven aromatic amines mentioned above under item 1, namely 4-aminodiphenylamine) as defined in amended independent claim 1, with regard to the composition defined therein, and in amended independent claim 18, with regard to the process defined therein, is not derivable in an obvious manner (Article 33(3) PCT) from the disclosure and teaching of the closest prior art D1 or from a combination of D1 with the content and teaching of any among D2 to D4, since none of the documents D1 to D4 relates to the problem of soot dispersion in the specific context specified in the present application (cf. the evidence shown with regard to the lubricant formulations subjected to the Mack™ T-11 test) and these documents cannot therefore provide a teaching which would have allowed to foreshadow the improvement associated to the claimed dispersant in this specific context of soot dispersion.

The composition of claims 2-8, the lubricant compositions of claims 9-13, the process for lubricating an internal combustion engine of claim 14, the process for improving the viscosity index of a lubricating oil of claim 15, the process for reducing soot-induced viscosity increase in a lubricating oil composition of claim 16 and the concentrate of claim 17 are dependent (either directly or indirectly) on amended independent claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Likewise, the processes of claims 19-21 are dependent on amended independent claim 18 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

3. The claimed subject-matter appears to be industrially applicable (Article 33(4) PCT).

Re Item VII

Certain defects in the international application

The description is not in conformity with the wording and scope of the amended set of claims [Rule 5.1(a)(iii) PCT].

What is claimed is:

1. A composition comprising the reaction product of:

(a) an isobutylene-diene copolymer having an $\overline{M}_n$ of about 1000 to about 150,000 and containing thereon an average of about 0.1 to 4 equivalents, per each 1000 units of $\overline{M}_n$ of the polymer, of carboxylic acid functionality or reactive equivalent thereof, derived from at least one α,β–unsaturated carboxylic compound; and

(b) an amine component comprising at least one aromatic amine containing at least one N-H group capable of condensing with said carboxylic acid functionality, selected from the group consisting of 4-phenylazoaniline, 4-aminodiphenylamine, 2-aminobenzimidazole, 3-nitroaniline, 4-(4-nitrophenylazo)aniline, N-(4-amino-5-methoxy-2-methyl-phenyl)-benzamide, N-(4-amino-2,5-dimethoxy-phenyl)-benzamide, N-(4-amino-2,5-diethoxy-phenyl)-benzamide, N-(4-amino-phenyl)-benzamide, 4-amino-2-hydroxy-benzoic acid phenyl ester, and N, N-dimethylphenylenediamine.

2. The composition of claim 1 wherein the diene is selected from the group consisting of isoprene, piperylene, 1,3-butadiene, and limonene.

3. The composition of claim 1 wherein the diene comprises isoprene.

4. The composition of claim 1 wherein (a) the copolymer containing carboxylic acid functionality is prepared by reacting (i) an isobutylene-diene copolymer having on average about 1 to about 150 moles of reactive carbon-carbon double bonds per mole of copolymer and about 0.1 to about 2 moles of said double bonds per 1000 units of $\overline{M}_n$ of the copolymer, with (ii) an α,β-unsaturated carboxylic compound.

5. The composition of claim 1 wherein the α,β-unsaturated carboxylic compound comprises an acrylic compound, a methacrylic compound, a maleic compound, a fumaric compound, or an itaconic compound.

6. The composition of claim 1 wherein the α,β-unsaturated carboxylic compound comprises maleic anhydride.

7. The composition of claim 1 wherein the amine component further comprises an amine having at least two N-H groups capable of condensing with said carboxylic acid functionality .

8. The composition of claim 7 wherein the amine having at least two N-H groups comprises ethylenediamine, 2,4-diaminotoluene, or phenylenediamine.

9. A lubricant composition comprising a major amount of an oil of lubricating viscosity and a minor amount of the composition of claim 1.

10. The lubricant composition of claim 9 further comprising at least one additive selected from the group consisting of detergents, dispersants, viscosity modifiers, pour point depressants, friction modifiers, antioxidants, and antiwear agents.

11. The lubricant composition prepared by admixing the components of claim 10.

12. The lubricant composition of claim 9 further comprising a polyisobutene succinimide dispersant having a N:CO ratio of greater than about 1.

13. The lubricant composition of claim 9 further comprising a hydrogenated copolymer of a vinylaromatic monomer with a conjugated polyene

14. A process for lubricating an internal combustion engine, comprising supplying thereto the lubricant of claim 9.

15. A process for improving the viscosity index of a lubricating oil composition comprising incorporating into said composition a minor, viscosity-improving amount, of the composition of claim 1.

16. A process for reducing soot-induced viscosity increase in a lubricating oil composition comprising incorporating into said composition a minor, viscosity-improving amount, of the composition of claim 1.

17. A concentrate comprising the composition of claim 1 and a concentrate-forming amount of an oil of lubricating viscosity.

18. A process for preparing a carboxylic derivative composition, comprising:

(a) reacting

(i) an isobutylene-diene copolymer having an $\overline{M}_n$ of about 1000 to about 150,000 and having on average about 0.1 to about 2 units of reactive carbon-carbon double bonds per each 1000 units of $\overline{M}_n$ of the polymer, with

(ii) an α,β-unsaturated carboxylic compound having carboxylic acid functionality or reactive equivalent thereof; and

(b) reacting the product of (a) with an amine component comprising at least one aromatic amine containing at least one N-H group capable of condensing with said carboxylic acid functionality, selected from the group consisting of 4-phenylazoaniline, 4-aminodiphenylamine, 2-aminobenzimidazole, 3-nitroaniline, 4-(4-nitrophenylazo)aniline, N-(4-amino-5-methoxy-2-methyl-phenyl)-benzamide, N-(4-amino-2,5-dimethoxy-phenyl)-benzamide, N-(4-amino-2,5-diethoxy-phenyl)-benzamide, N-(4-amino-phenyl)-benzamide, 4-amino-2-hydroxy-benzoic acid phenyl ester, and N, N-dimethylphenylene-diamine.

19. The process of claim 18 wherein the α,β-carboxylic compound is reacted with the isobutylene-diene polymer via a thermal reaction in the substantial absence of added chlorine.

20. The process of claim 18 wherein the α,β-carboxylic compound is reacted with the isobutylene-diene polymer via a radical reaction.

21. The process of claim 18 wherein the amine component of (b) further comprises an amine having at least two N-H groups capable of condensing with said carboxylic acid functionality.